PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of

Toshiyuki INAGAKI

Application No.: 10/582,673 Examiner: K. WALKER

Filed: June 22, 2006 Docket No.: 128357

For: FUEL CELL STACK STRUCTURE

BRIEF ON APPEAL

Appeal from Group 1726

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I. REAL PARTY IN INTEREST

The real party in interest for this appeal and the present application is Toyota Jidosha Kabushiki Kaisha, by way of an Assignment recorded in the U.S. Patent and Trademark Office beginning at Reel 017889, Frame 0337.

II. STATEMENT OF RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings, known to Appellant, Appellant's representative, or the Assignee, that may be related to, or which will directly affect or be directly affected by or have a bearing upon the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 27-29 and 31-39 are on appeal.

Claims 27-29 and 31-39 are pending.

Claims 27-29 and 31-39 are rejected.

Claims 1-26 and 30 are canceled.

IV. STATUS OF AMENDMENTS

No Amendment After Final Rejection has been filed.

V. SUMMARY OF CLAIMED SUBJECT MATTER

This disclosure relates to a fuel cell stack structure for a fuel cell energy source. (Specification, paragraph [0001]). In particular, the fuel cell stack includes a pair of separators and a membrane-electrode assembly (MEA) provided between the separators. (Specification, paragraph [0044]; and Fig. 2). An adhesive layer is provided between the pair of separators and has a Young's modulus within the range of 30 MPa to 50 MPa so that the stack-fastening load is borne more by the electricity generation region than the non-electricity generation region. (Specification, paragraphs [0070]-[0072]). The adhesive layer can have a thickness between 50 μm and 150 μm to best allow for the adhesive layer to serve as an elastic layer within the specified range of Young's modulus, even if hard spacers are inserted into the adhesive layer. (Specification, paragraphs [0049]-[0051]).

The invention of independent claim 27 recites the structure of the fuel cell stack, including the adhesive having a Young's modulus that causes the stack-fastening load to be borne more by the electricity generation region than the non-electricity generation region. In particular, independent claim 27 recites: A fuel cell stack comprising: a pair of separators (18, Fig. 2, paragraph [0044] lines 1 and 2); a membrane-electrode assembly (MEA) (MEA, Fig. 2, paragraph [0037], lines 1-3) in which an electrolyte membrane (11, Fig. 2., paragraph [0038] line 3), a catalyst layer (not numbered -disposed on a surface of at least one of the electrodes 14 or 17, Fig. 2., paragraph [0038], lines 2-5), and a diffusion layer (13 or 16, Fig. 2, paragraph [0038], lines 5 and 6) are laminated, and which is provided between the pair of separators (Fig. 2); and an adhesive layer (33, Fig. 2, paragraph [0047], lines 1 and 2) provided between the pair of separators, which contacts at least an end of the electrolyte membrane, an end of the catalyst layer and an end of the diffusion layer (Fig. 2), wherein the adhesive layer has a Young's modulus within the range of 30 MPa to 50 MPa (paragraph [0047], lines 1 and 2).

The invention of claim 31 recites the thickness of the adhesive layer that best allows for the adhesive layer to serve as an elastic layer within the specified range of Young's modulus, even if hard spacers are inserted into the adhesive layer. In particular, dependent claim 31 recites: The fuel cell stack according to claim 27, wherein; the adhesive layer has a thickness of 50 μm to 150 μm (paragraph [0048], line 1).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following grounds of rejection are presented for review:

(1) claims 27-29 and 35-38 are rejected under 35 U.S.C. §103(a) over Schmid et al. (U.S. Patent No. 6,080,503) in view of Araldite 2018 Technical Data Sheet (hereinafter "Araldite");

(2) claims 27 and 32-34 are rejected under 35 U.S.C. §103(a) over Schmid in view of Araldite;

(3) claims 27-29 and 35-38 are rejected under 35 U.S.C. §103(a) over Schmid in view of Kye (U.S. Patent Application Publication No. 2004/0197563) based further on Applicant's Remarks filed in the July 27, 2010 Amendment (considered by the Examiner as Applicant's Alleged Admitted Prior Art, hereinafter "AAAPA");

(4) claim 31 is rejected under 35 U.S.C. §103(a) over Schmid in view of Araldite and further in view of Uchida et al. (U.S. Patent No. 6,316,139); and

(5) claim 31 under 35 U.S.C. §103(a) over Schmid in view of Kye and further in view of Uchida and AAAPA.

VII. ARGUMENT

Appellant respectfully submits that the PTO has improperly applied the law relating to obviousness, and for the reasons discussed below, it is respectfully submitted that the rejections are in error and that all pending claims are in condition for allowance.

A. Independent Claim 27 Is Patentable Over Schmid In View Of Araldite

Regarding rejections (1) and (2), Schmid and Araldite, alone or combined, fail to disclose and would not have rendered obvious the claimed combination of features recited in independent claim 27. The above references fail to disclose and would not have rendered obvious the claimed fuel cell stack "wherein the adhesive layer has a Young's modulus within the range of 30 MPa to 50 MPa," as recited in independent claim 27.

The August 31, 2010 Final Rejection (hereinafter "Office Action") acknowledges that none of the applied references discloses the claimed combination of features including an adhesive at the claimed location and having a Young's modulus within the claimed range of 30 MPa to 50 MPa, but notes that the Young's modulus of Araldite is 16 MPa. Although the minimum claimed Young's modulus is almost twice that of Araldite, the Office Action asserts that the two elastic moduli "are not significantly different from each other." (See page 3 of the Office Action).

The claimed range of Young's modulus and the Young's modulus of Araldite are patentably distinct from one another. The Office Action cites *Titanium Metals Corp. v. Banner*, 778 F.2d 775 (Fed. Cir. 1985), in which claims to a titanium alloy with 0.8% nickel and 0.3% molybdenum were held to be obvious over a prior art reference which disclosed an alloy containing 0.75% nickel and 0.25% molybdenum. (See also MPEP §2131.03 (III)). However, in *Titanium Metals*, the prior art alloy was considered to be "close enough" to the claimed alloy so as to support a §103 obviousness rejection because "one skilled in the art would have expected them to have the same properties." (*Titanium Metals*, 778 F.2d at 783).

In the present case, one skilled in the art would have known that the minimum Young's modulus recited in independent claim 27 and the disclosed Young's modulus do not have the same properties. Rather, the minimum Young's modulus in the claimed range would be nearly twice as stiff as the Young's modulus disclosed in the prior art. Thus, the facts of *Titanium Metals* and the present Application's facts are inapposite, and a Young's modulus of 16 MPa and 30 MPa are significantly different from each other.

B. Independent Claim 27 Is Patentable Over Schmid In View Of Kye And AAAPA

Regarding rejection (3), Schmid, Kye and AAAPA, alone or combined, fail to disclose and would not have rendered obvious the claimed combination of features recited in independent claim 27. The above references fail to disclose and would not have rendered obvious "A fuel cell stack comprising ... an adhesive layer ... wherein the adhesive layer has a Young's modulus within the range of 30 MPa to 50 MPa," as recited in independent claim 27.

The Office Action argues on page 14 that the claimed range of Young's modulus is a result-effective variable, and refuses to afford this feature patentable weight absent any showing of unexpected results. However, Appellant's invention is not directed to the adhesive itself; rather, Appellant's invention is directed to a fuel cell structure that incorporates a known adhesive. That is, while adhesives having a Young's modulus between 30 MPa and 50 MPa are known, such adhesives are not known to have been used to adhere a pair of separators in a fuel cell structure, as claimed.

It would not have been obvious to combine known adhesives having a Young's modulus within the range of 30 MPa to 50 MPa with the structure of Schmid. Indeed, the claimed adhesive has a Young's modulus within the range of 30 MPa to 50 MPa so that the stack-fastening load is borne more by the electricity generation region than the non-electricity

generation region. (Specification, paragraphs [0070]-[0072]). The adhesive layer thereby reduces the variance of the load applied to the electricity generation region by limiting the amount of the fastening load that is borne by the non-electricity generation region. (Specification, paragraphs [0005]-[0007] and [0070]-[0072]). The claimed adhesive in the claimed location also reduces the fastening load that must be applied to the fuel cell stack as a whole by limiting the amount of the fastening load that is borne by the non-electricity generation region. (See *Id.*). As a result, the adhesive of claim 27 allows for easier management of the surface pressure applied to the electricity generation region and limits the possibility of cracking or deformation of separators due to an excessively large fastening load. (See *Id.*). The present claims resolve the above problem based on the selection of the claimed adhesive - the cited art does not. The inventor of the present claims thus discovered a novel resolution to a problem not disclosed by the prior art. This is part of the "subject matter as a whole" that must be considered by the Examiner. (MPEP §2141.02(III)).

The Office Action asserts that it is well known in the art to vary the Young's modulus of an adhesive within a fuel cell stack to achieve preferred properties of tensile strength, percent elongation and stiffness. (Office Action, page 14). The Office Action asserts that such a teaching is established by Kye. (*Id.*). Although Kye never discloses the use of its adhesive within a fuel cell stack, the Office Action relies on Schmid to disclose that general adhesives are used within the fuel cell art, and relies on Kye for the teaching that varying the Young's modulus within an adhesive can produce optimized properties of elongation, stiffness and tensile strength, such that the claimed range of Young's modulus is a result-effective variable. (*Id.*).

As discussed above, neither Schmid nor Kye recognize the problem discovered by Appellant - that excessive fastening load was borne by the non-electricity generation region rather than by the electricity generation region. The Office Action asserts that it would have

been obvious to modify the adhesive of Schmid based on the teachings of Kye to achieve Appellant 's specific range of Young's moduli because:

> by varying the young's modulus of an adhesive material, the tensile strength changes and the percentage of elongation before breaking changes ... [s]o by increasing the young's modulus of the adhesive material, the tensile strength increases and the amount of elongation before the adhesive breaks decreases. Therefore, one of ordinary skill in the art could optimize the properties of tensile strength and elongation to match the type and operating conditions of the fuel cell. (Office Action, page 11, emphasis added).

However, Appellant does not select the claimed Young's modulus range to avoid breakage.

Appellant does not dispute that the Young's modulus, tensile strength, and percent elongation before breaking are related to one another. Indeed, the above characteristics are simple material properties that define the mechanical behavior of a material. But the Office Action provides no reason as to why would one of ordinary skill would modify the Young's modulus of an adhesive "to match the type and operating conditions of the fuel cell." (Office Action, page 11). The above assertion essentially argues that one of ordinary skill would have been motivated to modify the Young's modulus of the adhesive in Schmid to be any value depending on the numerous conditions of the fuel cell. Such an assertion is unsupported by fact.

The Office Action also mischaracterizes statements made by the Appellant. The Office Action asserts on page 14 that "[a]s discussed by Appellant, use of an adhesive with the claimed Young's modulus in the fuel cell art is well known." However, Appellant never made any such admission. Rather, Appellant merely argued that the present claims "are directed to a novel fuel cell stack with an adhesive having the claimed Young's modulus, not a method of making such an adhesive or the adhesive itself." (July 27, 2010 Amendment,

page 5). Appellant never acknowledged that the combination of the claimed adhesive within the claimed fuel cell structure is known in the art, as alleged by the Office Action.

The Office Action's proposed combination fails to consider the combination of Appellant 's claimed features. Neither Kye nor Schmid discloses the use of an adhesive with a Young's Modulus between 30 MPa and 50 MPa to adhere a pair of separators within a fuel cell. Although the various claimed elements may have been known individually, it is well settled that a combination of known components may be patentable. *See, e.g., In re Wright*, 848 F.2d 1216 (Fed Cir. 1988), holding a combination of known mechanical elements to be nonobvious over the prior art, which disclosed the individual elements in isolation but not the combination of the elements.

Indeed, all inventions involve a combination of known elements. As the late Chief Judge Markey (the first Chief Judge of the Federal Circuit) once famously quoted "virtually all inventions are 'combinations,' and ... every invention is formed of 'old elements' .... Only God works from nothing, Man must work with old elements." (H.T. Markey, Why Not the Statute?, 65 J.Pat.Off.Soc'y 331, 333-34 (1983)). Appellant respectfully submits that the claimed combination of features is novel and nonobvious. Such a combination is not disclosed by the prior art and would not have been obvious over the prior art.

C. Dependent Claim 31 Is Patentable Over Schmid In View Of Araldite And Further In View Of Uchida; And Is Patentable Over Schmid In View Of Kye And Further In View Of Uchida And AAAPA

Dependent claim 31 recites "The fuel cell stack according to claim 27, wherein; the adhesive layer has a thickness of 50 μm to 150 μm." Stated differently, claim 31 recites an adhesive layer within a fuel cell stack having the combination of the claimed range of Young's modulus recited in claim 27 (30 MPa - 50 MPa) together with the claimed range of thickness recited in claim 31 (50 μm to 150 μm).

One of ordinary skill would not have been motivated to combine the thickness of the adhesive in Uchida with an adhesive having a Young's modulus between 30 MPa - 50 MPa. The Office Action asserts that Uchida discloses an adhesive having a thickness between 10 - 300 μm. (Office Action, pages 9 and 12). However, the adhesive 22 of Uchida is applied to an elastomer layer 23 of a gasket 21 to prevent shifting of the elastomer layer 23 by the adhesive force of the adhesive 22. (Uchida, col. 4, lines 56-67). In other words, the adhesive 22 of Uchida is provided to reduce the elasticity between the objects to which it is applied. (*See Id.*). However, the adhesive of claims 27 and 31 is more elastic than the conventional prior art adhesive, and the claimed thickness allows for the adhesive layer to serve as an elastic layer within the specified range of Young's modulus, even if hard spacers are inserted into the adhesive layer. (Specification, paragraphs [0049]-[0051]). Thus, combining the adhesive of Uchida (having a thickness between 10 μm and 300 μm) with an adhesive having a Young's modulus between 30 MPa - 50 MPa would negate the specific teachings of Uchida by rendering the adhesive layer more elastic, not less elastic.

Further, the adhesive of Uchida is provided on an elastomer layer 23 of a gasket 21, not "between the pair of separators, which contacts at least an end of the electrolyte membrane, an end of the catalyst layer and an end of the diffusion layer," as recited in independent claim 27. The adhesive in Uchida is provided on a completely different structure of the fuel cell for a completely different purpose. There is no teaching in Uchida or any other cited art that would have lead the skilled artisan to modify the structure of Schmid to include specific properties of an adhesive from a gasket.

VIII. CONCLUSION

For all of the reasons discussed above, it is respectfully submitted that the rejections are in error and that claims 27-29 and 31-39 are in condition for allowance. For all of the above reasons, Appellants respectfully request this Honorable Board to reverse the rejections of claims 27-29 and 31-39.

Respectfully submitted,

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APPENDIX A - CLAIMS APPENDIX

CLAIMS INVOLVED IN THE APPEAL:

27. A fuel cell stack comprising:

a pair of separators;

a membrane-electrode assembly (MEA) in which an electrolyte membrane, a catalyst layer, and a diffusion layer are laminated, and which is provided between the pair of separators; and

an adhesive layer provided between the pair of separators, which contacts at least an end of the electrolyte membrane, an end of the catalyst layer and an end of the diffusion layer, wherein the adhesive layer has a Young's modulus within the range of 30 MPa to 50 MPa.

28. The fuel cell stack according to claim 27, wherein;

the electrolyte membrane has an extended portion which extends beyond the end of the catalyst layer and the end of the diffusion layer, and

a portion of the adhesive layer is provided between the extended portion of the electrolyte membrane and one of the pair of separators so as to contact a surface of the extended portion, and another portion of the adhesive layer is provided between the extended portion of the electrolyte membrane and another of the pair of separators so as to contact another surface of the extended portion.

29. The fuel cell stack according to claim 27, wherein;

a portion of the adhesive layer is provided between one of the pair of separators and the catalyst layer so as to contact a surface of the catalyst layer; and another portion of the adhesive layer is provided between another of the pair of separators and the diffusion layer so as to contact a surface of the diffusion layer.

31. The fuel cell stack according to claim 27, wherein;

the adhesive layer has a thickness of 50 μm to 150 μm.

32. The fuel cell stack according to claim 27, wherein a rigid spacer is provided in the adhesive layer.

33. The fuel cell stack according to claim 32, wherein the rigid spacer is provided in the adhesive layer throughout a non-generation region.

34. The fuel cell stack according to claim 32, wherein the adhesive layer has a thickness that allows the adhesive layer to have a Young's modulus of at most 50 MPa even if the hard spacer is provided in the adhesive layer.

35. The fuel cell stack according to claim 27, wherein multiple cells, each of which is formed by interposing the MEA between the pair of separators, are linearly arranged in a cell stacking direction, and the fuel cell stack further comprises an adhesive layer sandwiched between two cells adjacent to each other.

36. The fuel cell stack according to claim 27, wherein multiple cells, each of which is formed by interposing the MEA between the pair of separators, are linearly arranged in a cell stacking direction, and a bead gasket is provided as a seal between two of the multiple cells, which are adjacent to each other, and a separator of the two of the multiple cells which contacts the bead gasket has a greater planar rigidity than a separator of another cell which does not contact the bead gasket.

37. The fuel cell stack according to claim 33, further comprising a generally flat plate which is placed on the separator which contacts the bead gasket to increase the planar rigidity of the separator.

38. The fuel cell stack according to claim 27, wherein the adhesive layer is provided between the separators in an entire non-power generation region.

39. The fuel cell stack according to claim 27, wherein the adhesive layer contains rigid beads each of which has a diameter equal to or smaller than a thickness of the adhesive layer.

APPENDIX B - EVIDENCE APPENDIX

NONE

APPENDIX C - RELATED PROCEEDINGS APPENDIX

NONE